FIG. 1

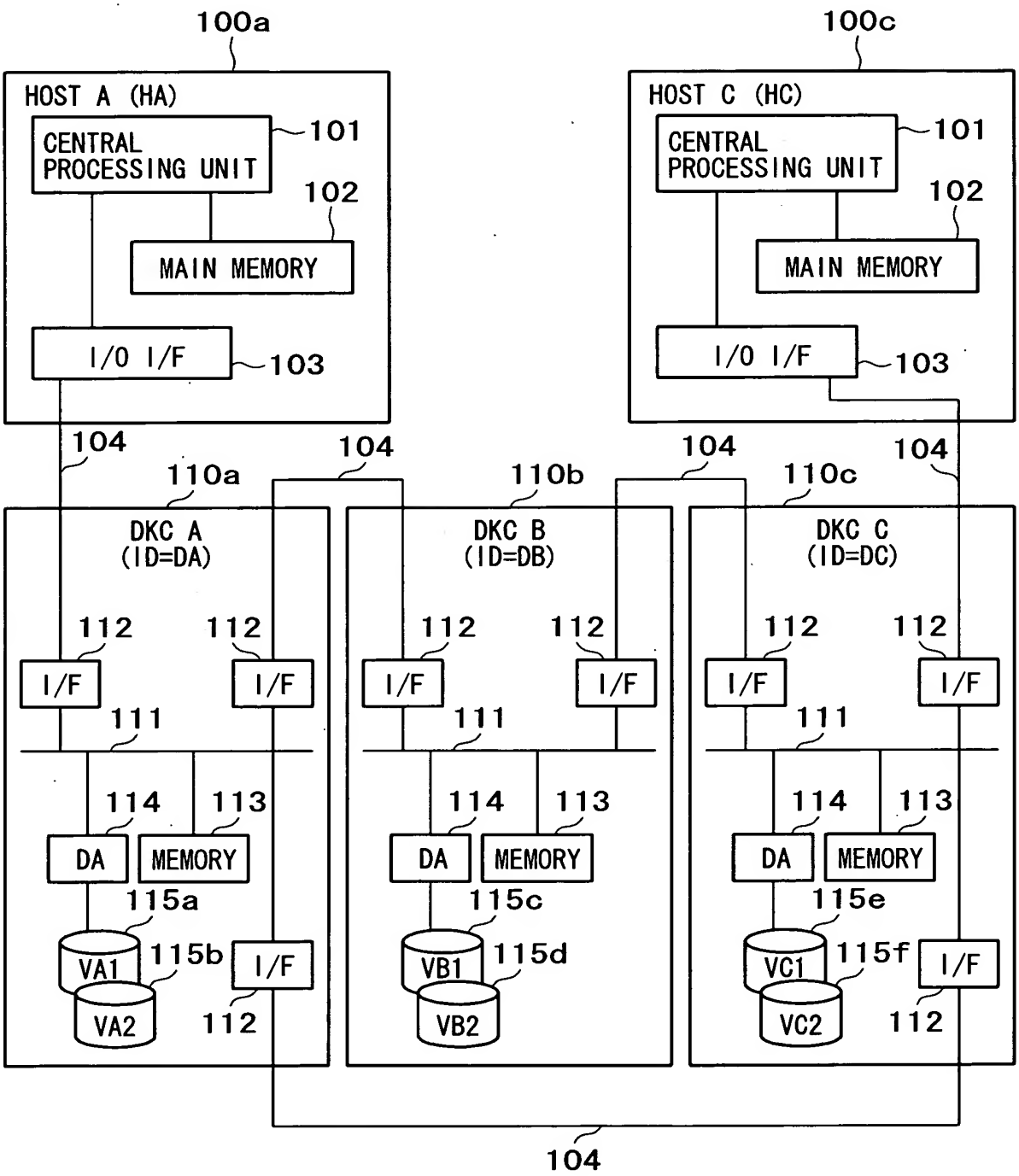

100a
100c
HOST A (HA)
HOST C (HC)
CENTRAL PROCESSING UNIT
101
102
MAIN MEMORY
I/O I/F
103
104
110a
110b
110c
DKC A (ID=DA)
DKC B (ID=DB)
DKC C (ID=DC)
112
I/F
111
114
113
DA
MEMORY
115a
115b
115c
115d
115e
115f
VA1
VA2
VB1
VB2
VC1
VC2

FIG. 2

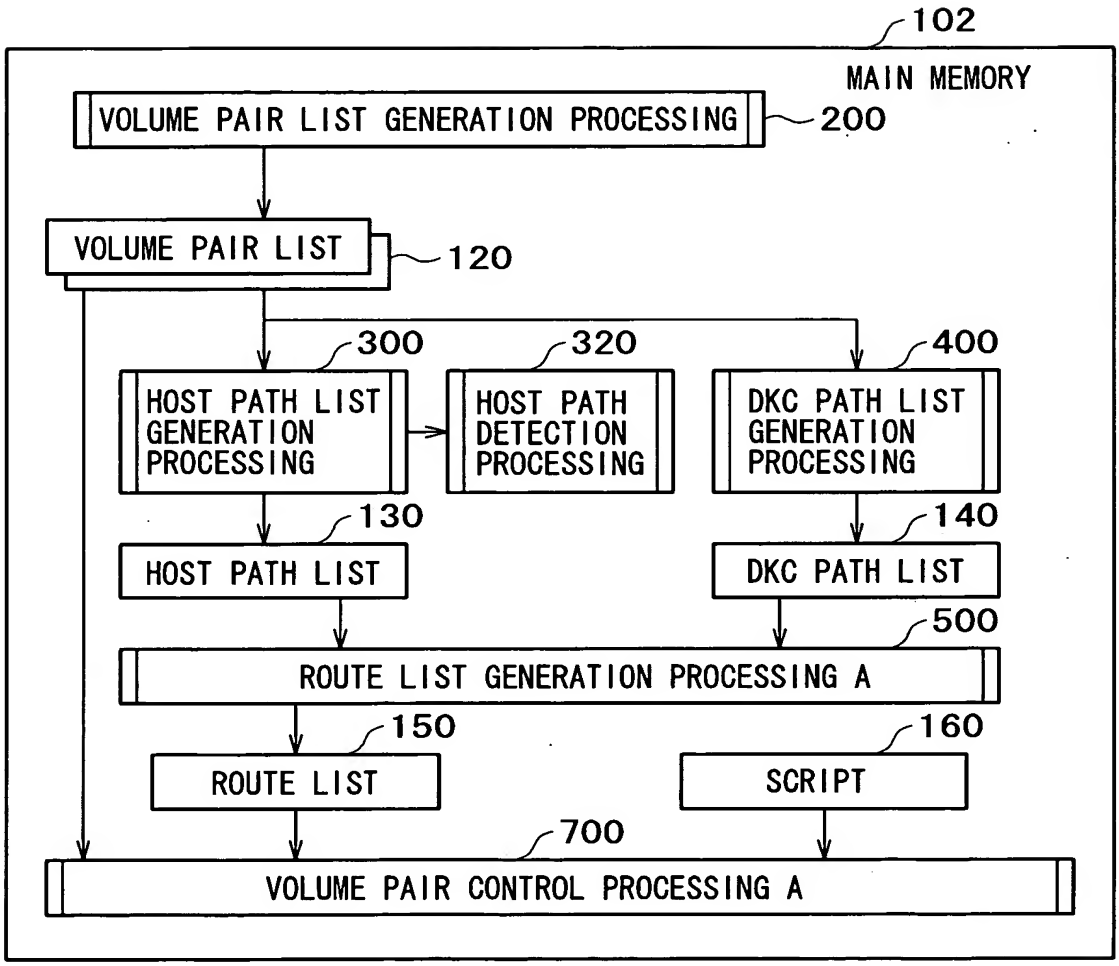

102
MAIN MEMORY
VOLUME PAIR LIST GENERATION PROCESSING
200
VOLUME PAIR LIST
120
300
320
400
HOST PATH LIST GENERATION PROCESSING
HOST PATH DETECTION PROCESSING
DKC PATH LIST GENERATION PROCESSING
130
140
HOST PATH LIST
DKC PATH LIST
500
ROUTE LIST GENERATION PROCESSING A
150
160
ROUTE LIST
SCRIPT
700
VOLUME PAIR CONTROL PROCESSING A

FIG. 3A

120a

```
<PairList>
<ID>PairAB</ID>
<Pair><prim seq#=DA, dev#=VA1><sec seq#=DB, dev#=VB1></Pair>
<Pair><prim seq#=DA, dev#=VA2><sec seq#=DB, dev#=VB2></Pair>
</PairList>
```

FIG. 3B

120b

```
<PairList>
<ID>PairBC</ID>
<Pair><prim seq#=DB, dev#=VB1><sec seq#=DC, dev#=VC1></Pair>
<Pair><prim seq#=DB, dev#=VB2><sec seq#=DC, dev#=VC2></Pair>
</PairList>
```

FIG. 3C

120c

```
<PairList>
<ID>PairAC</ID>
<Pair><prim seq#=DA, dev#=VA1><sec seq#=DC, dev#=VC1></Pair>
<Pair><prim seq#=DA, dev#=VA2><sec seq#=DC, dev#=VC2></Pair>
</PairList>
```

FIG. 4

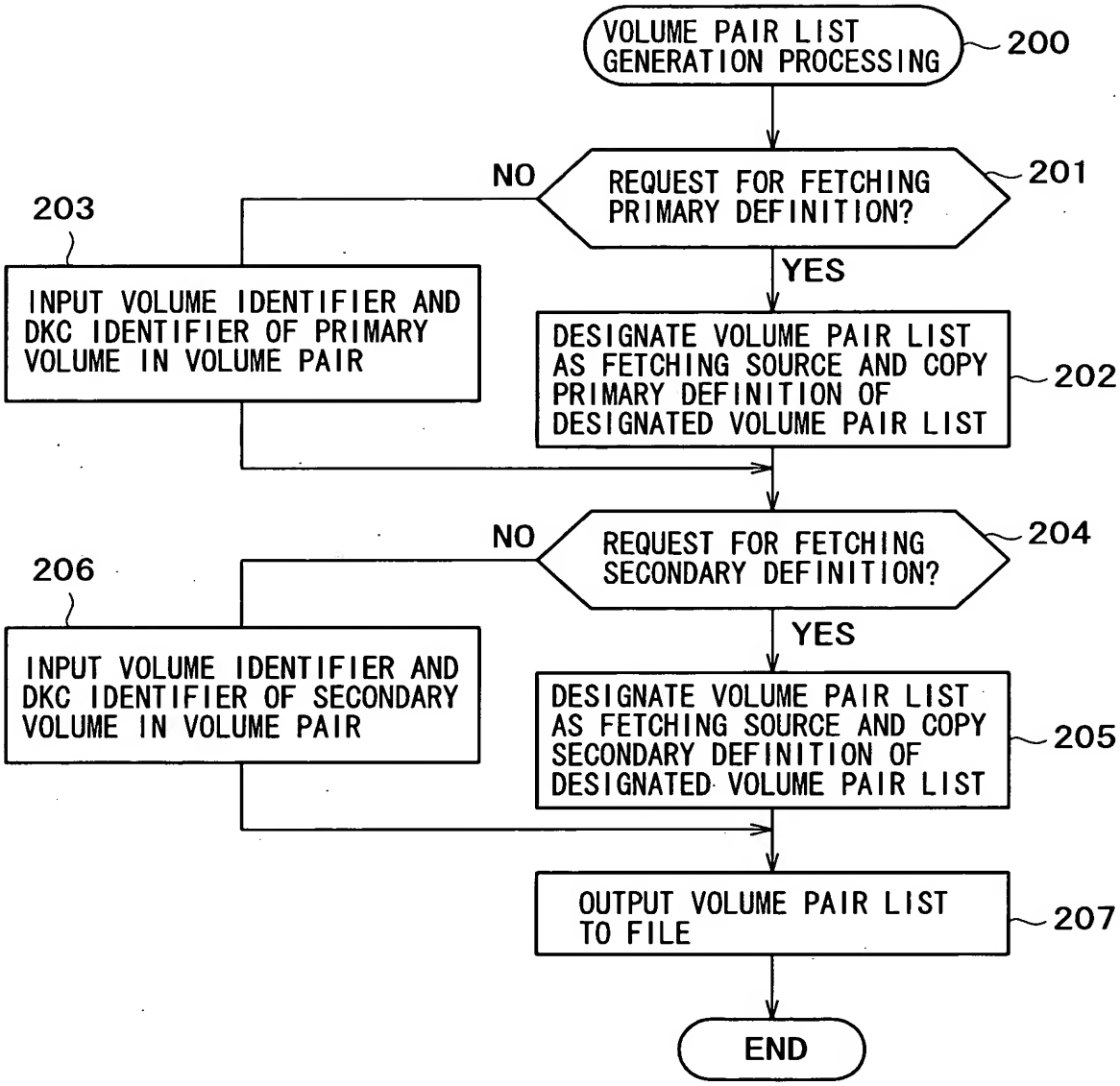

VOLUME PAIR LIST GENERATION PROCESSING
200
REQUEST FOR FETCHING PRIMARY DEFINITION?
201
NO
YES
203
INPUT VOLUME IDENTIFIER AND DKC IDENTIFIER OF PRIMARY VOLUME IN VOLUME PAIR
DESIGNATE VOLUME PAIR LIST AS FETCHING SOURCE AND COPY PRIMARY DEFINITION OF DESIGNATED VOLUME PAIR LIST
202
REQUEST FOR FETCHING SECONDARY DEFINITION?
204
NO
YES
206
INPUT VOLUME IDENTIFIER AND DKC IDENTIFIER OF SECONDARY VOLUME IN VOLUME PAIR
DESIGNATE VOLUME PAIR LIST AS FETCHING SOURCE AND COPY SECONDARY DEFINITION OF DESIGNATED VOLUME PAIR LIST
205
OUTPUT VOLUME PAIR LIST TO FILE
207
END

FIG. 5

130

```
<HostPathList>
<ID>3DC</ID>
<path><host=HA, DKC=DA></path>
<path><host=HC, DKC=DC></path>
</HostPathList>
```

FIG. 6

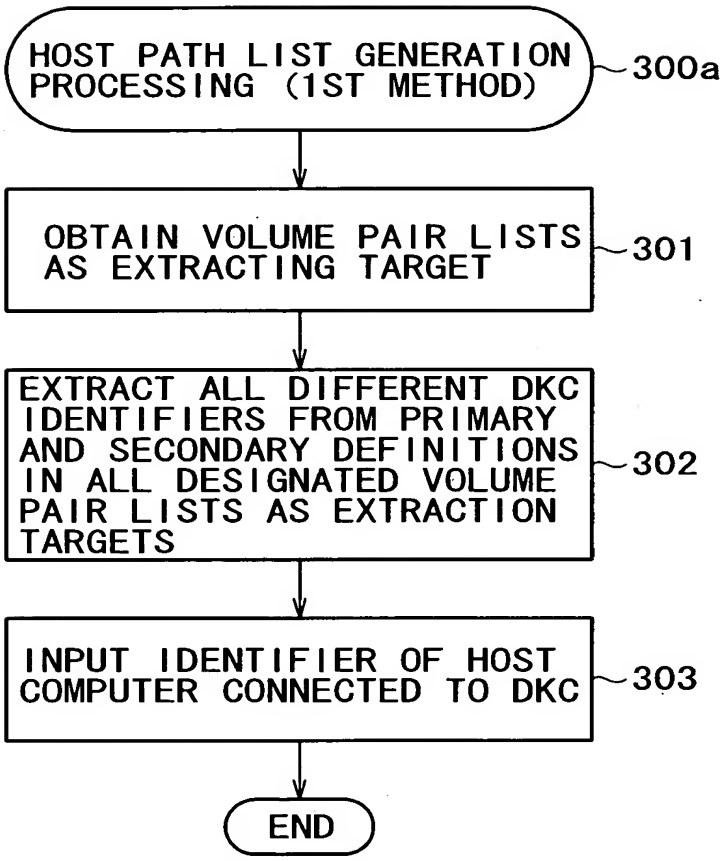

HOST PATH LIST GENERATION PROCESSING (1ST METHOD)
300a
OBTAIN VOLUME PAIR LISTS AS EXTRACTING TARGET
301
EXTRACT ALL DIFFERENT DKC IDENTIFIERS FROM PRIMARY AND SECONDARY DEFINITIONS IN ALL DESIGNATED VOLUME PAIR LISTS AS EXTRACTION TARGETS
302
INPUT IDENTIFIER OF HOST COMPUTER CONNECTED TO DKC
303
END

FIG. 7

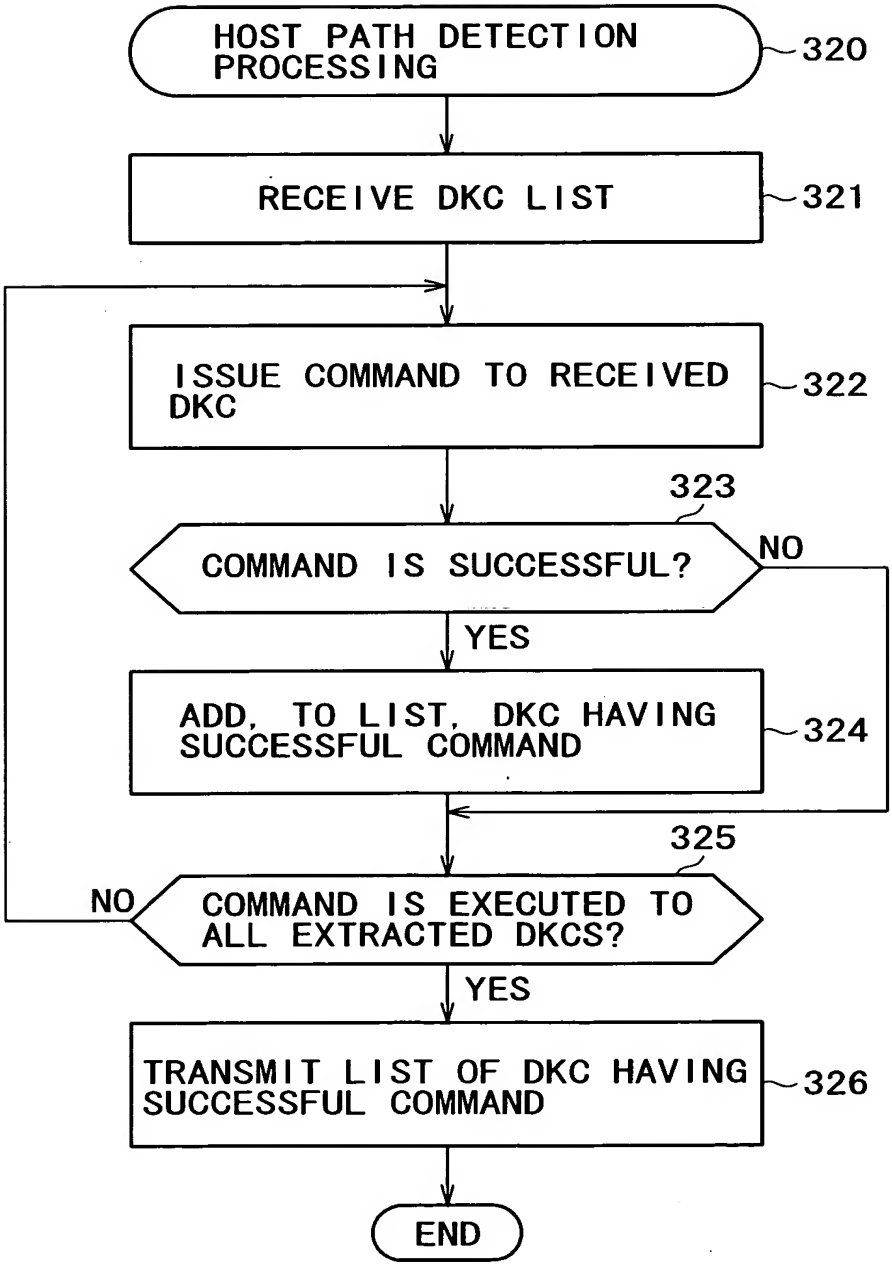

HOST PATH DETECTION PROCESSING
320
RECEIVE DKC LIST
321
ISSUE COMMAND TO RECEIVED DKC
322
323
COMMAND IS SUCCESSFUL?
NO
YES
ADD, TO LIST, DKC HAVING SUCCESSFUL COMMAND
324
325
NO
COMMAND IS EXECUTED TO ALL EXTRACTED DKCS?
YES
TRANSMIT LIST OF DKC HAVING SUCCESSFUL COMMAND
326
END

FIG. 8

140

```
<DKCPathList>
<ID>3DC</ID>
<path><DKC=DA, DKC=DB></path>
<path><DKC=DB, DKC=DC></path>
<path><DKC=DA, DKC=DC></path>
</DKCPathList>
```

FIG. 9

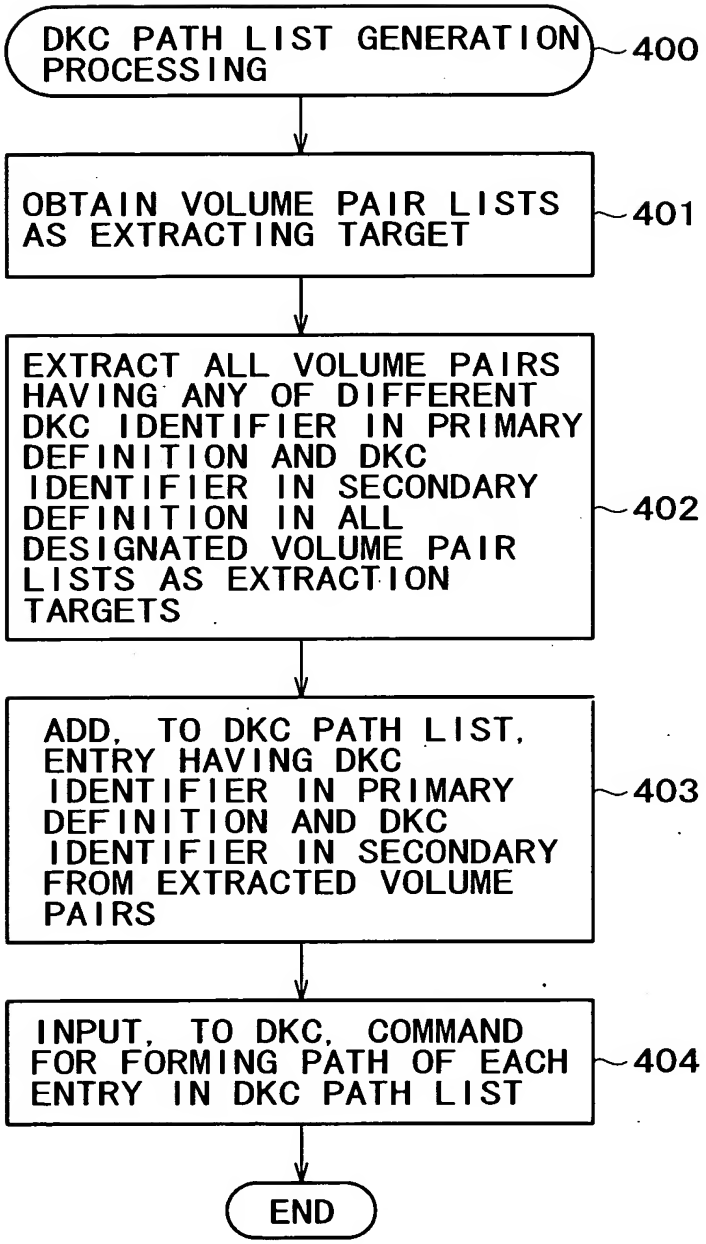

DKC PATH LIST GENERATION PROCESSING
400
OBTAIN VOLUME PAIR LISTS AS EXTRACTING TARGET
401
EXTRACT ALL VOLUME PAIRS HAVING ANY OF DIFFERENT DKC IDENTIFIER IN PRIMARY DEFINITION AND DKC IDENTIFIER IN SECONDARY DEFINITION IN ALL DESIGNATED VOLUME PAIR LISTS AS EXTRACTION TARGETS
402
ADD, TO DKC PATH LIST, ENTRY HAVING DKC IDENTIFIER IN PRIMARY DEFINITION AND DKC IDENTIFIER IN SECONDARY FROM EXTRACTED VOLUME PAIRS
403
INPUT, TO DKC, COMMAND FOR FORMING PATH OF EACH ENTRY IN DKC PATH LIST
404
END

FIG. 10

150a

priority	host	route
1	HA	DA-DB-DC
1	HA	DA-DB
1	HA	DA
2	HA	DA-DC-DB
2	HA	DA-DC
1	HC	DC-DB-DA
1	HC	DC-DB
1	HC	DC
2	HC	DC-DB-DA
2	HC	DC-DB

FIG. 11

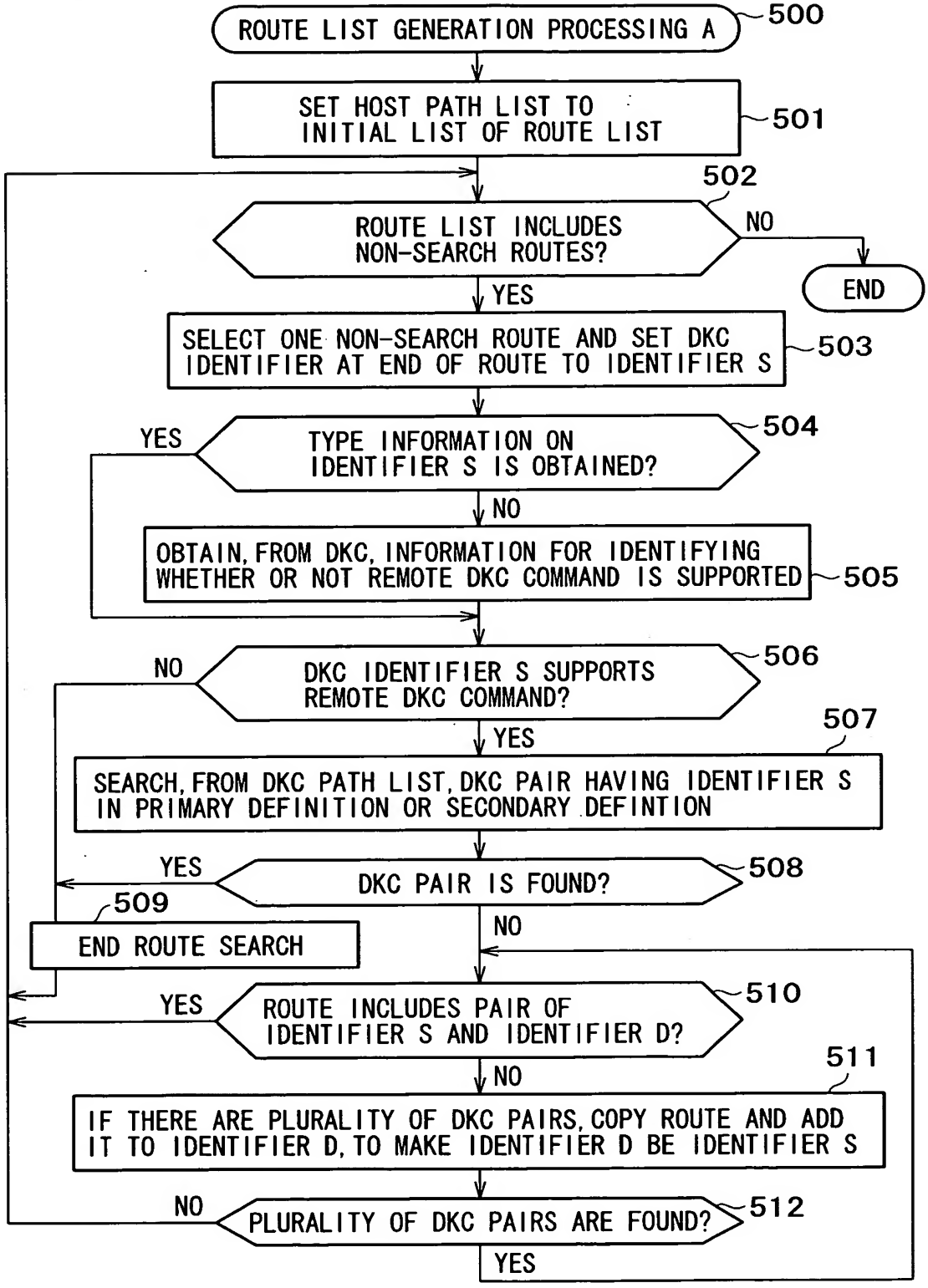

ROUTE LIST GENERATION PROCESSING A
500
SET HOST PATH LIST TO INITIAL LIST OF ROUTE LIST
501
502
ROUTE LIST INCLUDES NON-SEARCH ROUTES?
NO
END
YES
SELECT ONE NON-SEARCH ROUTE AND SET DKC IDENTIFIER AT END OF ROUTE TO IDENTIFIER S
503
YES
TYPE INFORMATION ON IDENTIFIER S IS OBTAINED?
504
NO
OBTAIN, FROM DKC, INFORMATION FOR IDENTIFYING WHETHER OR NOT REMOTE DKC COMMAND IS SUPPORTED
505
NO
DKC IDENTIFIER S SUPPORTS REMOTE DKC COMMAND?
506
YES
507
SEARCH, FROM DKC PATH LIST, DKC PAIR HAVING IDENTIFIER S IN PRIMARY DEFINITION OR SECONDARY DEFINTION
YES
DKC PAIR IS FOUND?
508
509
END ROUTE SEARCH
NO
YES
ROUTE INCLUDES PAIR OF IDENTIFIER S AND IDENTIFIER D?
510
NO
511
IF THERE ARE PLURALITY OF DKC PAIRS, COPY ROUTE AND ADD IT TO IDENTIFIER D, TO MAKE IDENTIFIER D BE IDENTIFIER S
NO
PLURALITY OF DKC PAIRS ARE FOUND?
512
YES

FIG. 12

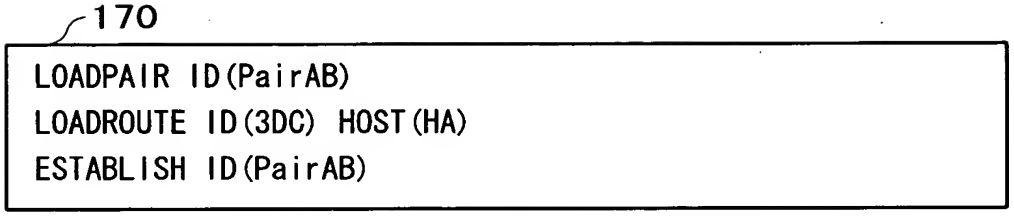

170
LOADPAIR ID(PairAB)
LOADROUTE ID(3DC) HOST(HA)
ESTABLISH ID(PairAB)

FIG. 13

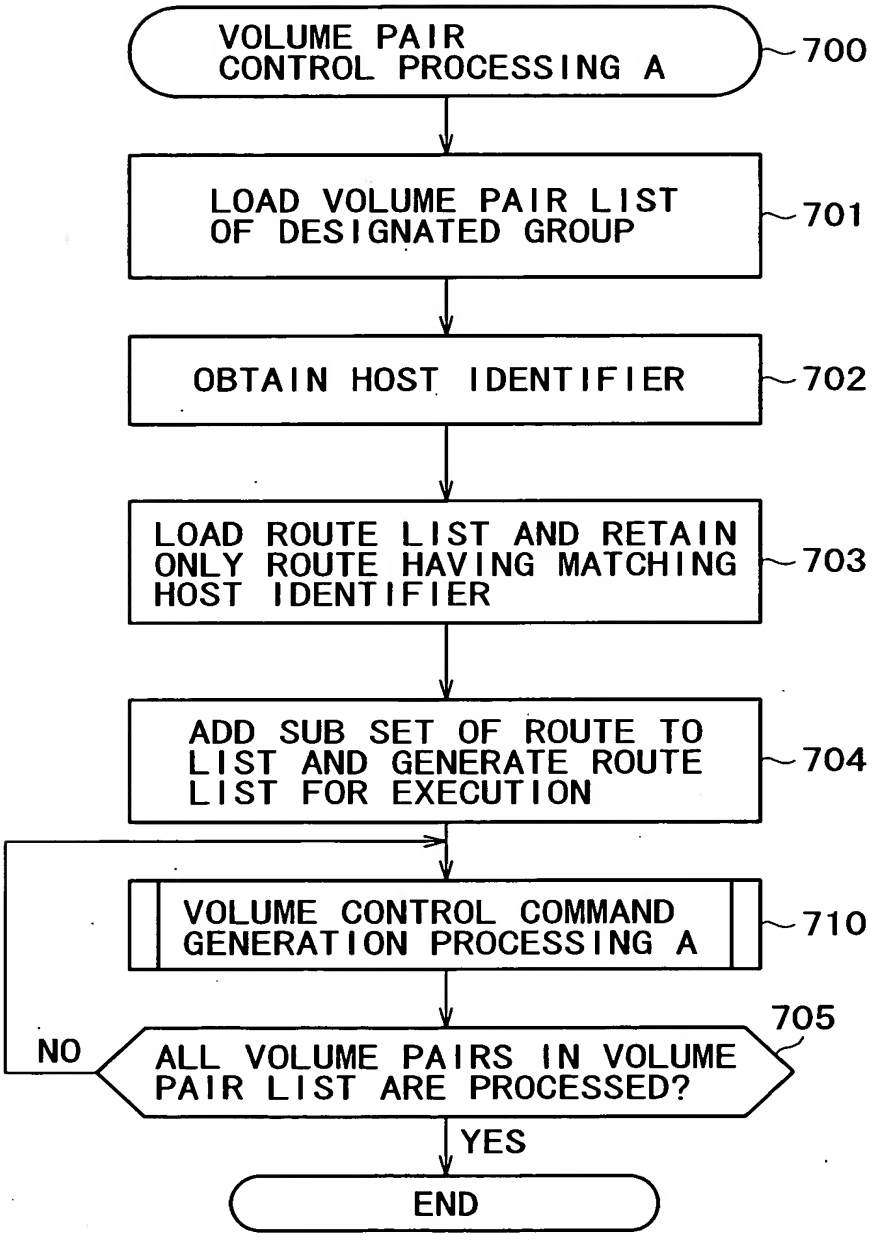

VOLUME PAIR CONTROL PROCESSING A
700
LOAD VOLUME PAIR LIST OF DESIGNATED GROUP
701
OBTAIN HOST IDENTIFIER
702
LOAD ROUTE LIST AND RETAIN ONLY ROUTE HAVING MATCHING HOST IDENTIFIER
703
ADD SUB SET OF ROUTE TO LIST AND GENERATE ROUTE LIST FOR EXECUTION
704
VOLUME CONTROL COMMAND GENERATION PROCESSING A
710
705
NO
ALL VOLUME PAIRS IN VOLUME PAIR LIST ARE PROCESSED?
YES
END

FIG. 14

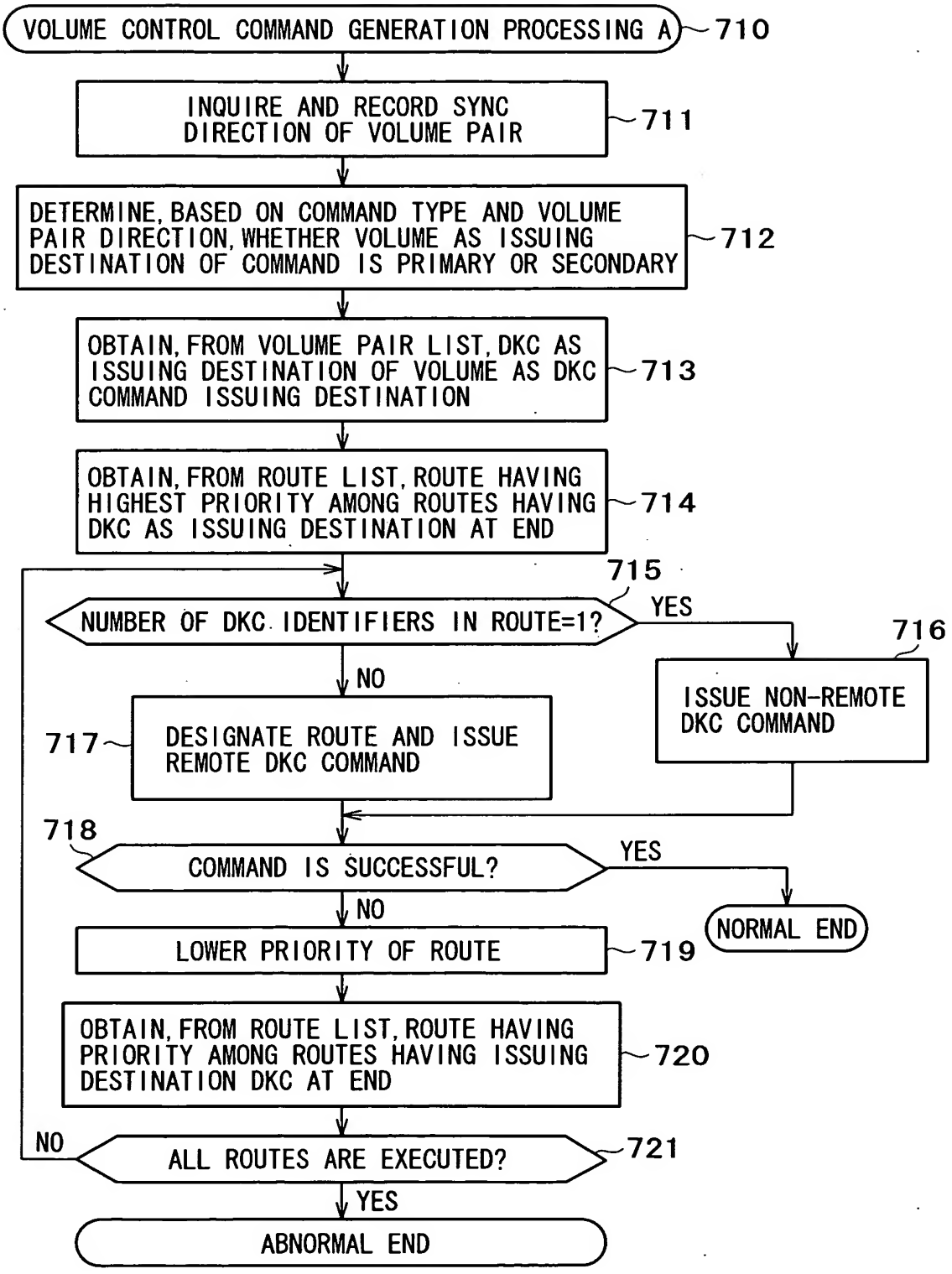

VOLUME CONTROL COMMAND GENERATION PROCESSING A
710
INQUIRE AND RECORD SYNC DIRECTION OF VOLUME PAIR
711
DETERMINE, BASED ON COMMAND TYPE AND VOLUME PAIR DIRECTION, WHETHER VOLUME AS ISSUING DESTINATION OF COMMAND IS PRIMARY OR SECONDARY
712
OBTAIN, FROM VOLUME PAIR LIST, DKC AS ISSUING DESTINATION OF VOLUME AS DKC COMMAND ISSUING DESTINATION
713
OBTAIN, FROM ROUTE LIST, ROUTE HAVING HIGHEST PRIORITY AMONG ROUTES HAVING DKC AS ISSUING DESTINATION AT END
714
715
NUMBER OF DKC IDENTIFIERS IN ROUTE=1?
YES
716
ISSUE NON-REMOTE DKC COMMAND
NO
717
DESIGNATE ROUTE AND ISSUE REMOTE DKC COMMAND
718
COMMAND IS SUCCESSFUL?
YES
NORMAL END
NO
LOWER PRIORITY OF ROUTE
719
OBTAIN, FROM ROUTE LIST, ROUTE HAVING PRIORITY AMONG ROUTES HAVING ISSUING DESTINATION DKC AT END
720
NO
ALL ROUTES ARE EXECUTED?
721
YES
ABNORMAL END

FIG. 15A

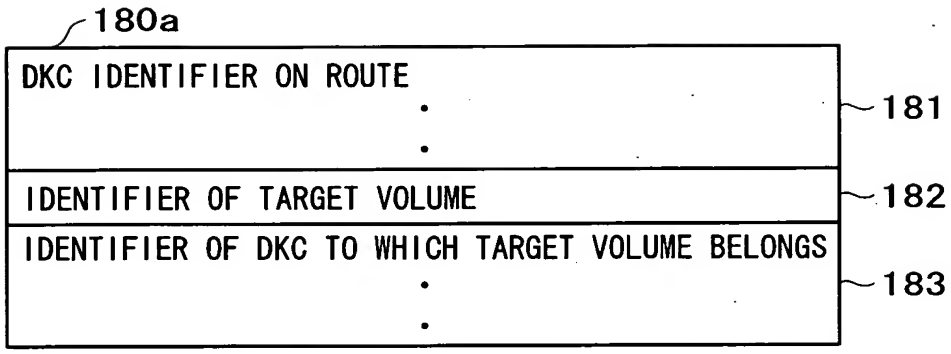


FIG. 15B

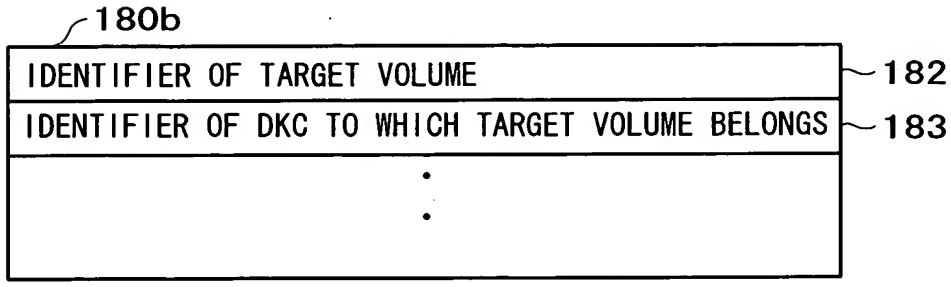


FIG. 16

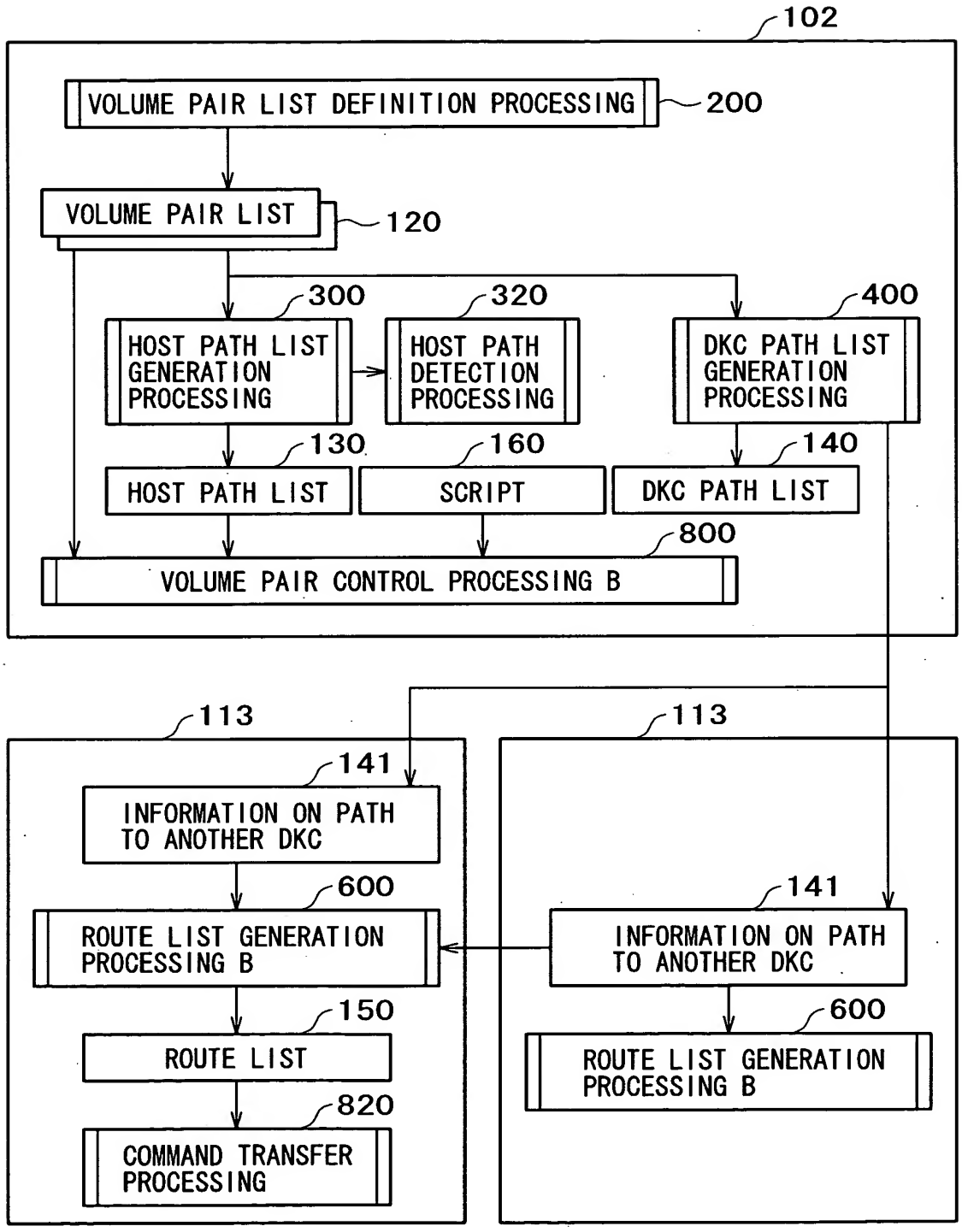

102
VOLUME PAIR LIST DEFINITION PROCESSING
200
VOLUME PAIR LIST
120
300
320
400
HOST PATH LIST GENERATION PROCESSING
HOST PATH DETECTION PROCESSING
DKC PATH LIST GENERATION PROCESSING
130
160
140
HOST PATH LIST
SCRIPT
DKC PATH LIST
800
VOLUME PAIR CONTROL PROCESSING B
113
113
141
INFORMATION ON PATH TO ANOTHER DKC
600
ROUTE LIST GENERATION PROCESSING B
141
INFORMATION ON PATH TO ANOTHER DKC
150
600
ROUTE LIST
ROUTE LIST GENERATION PROCESSING B
820
COMMAND TRANSFER PROCESSING

FIG. 17

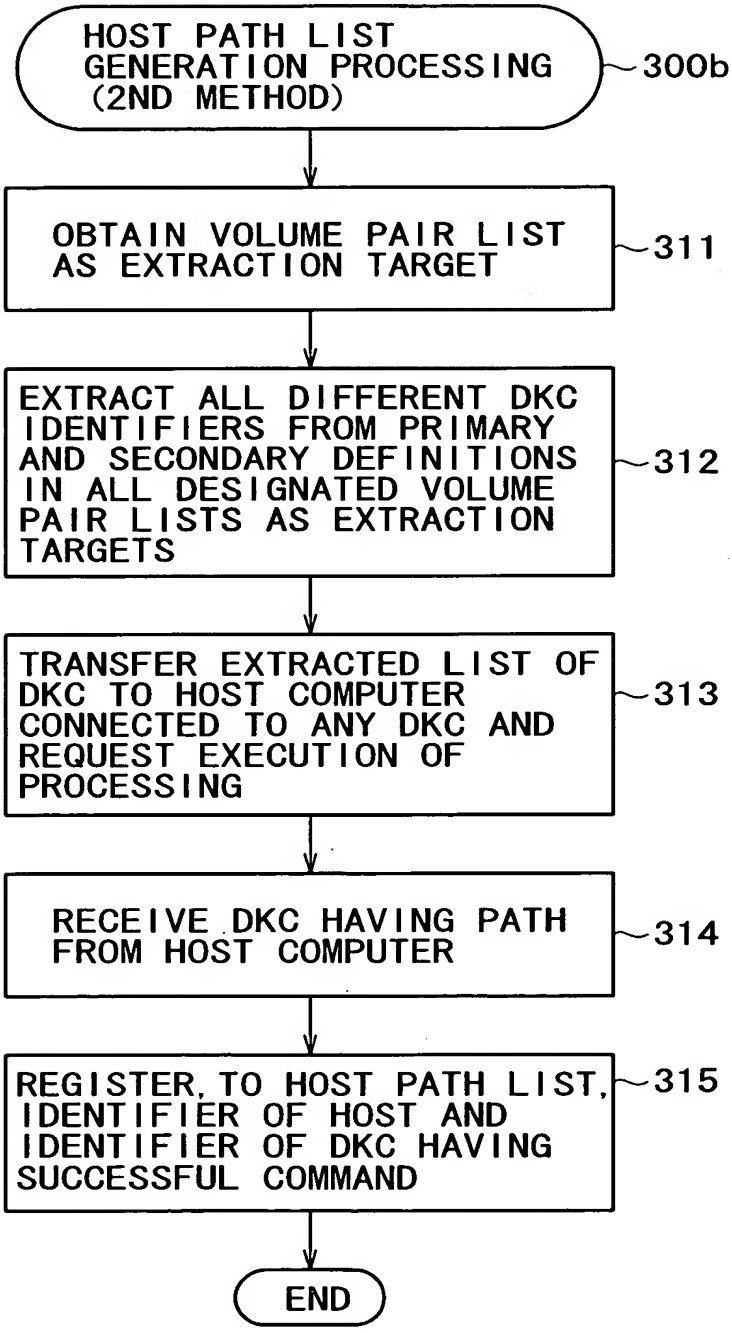

HOST PATH LIST GENERATION PROCESSING (2ND METHOD)
300b
OBTAIN VOLUME PAIR LIST AS EXTRACTION TARGET
311
EXTRACT ALL DIFFERENT DKC IDENTIFIERS FROM PRIMARY AND SECONDARY DEFINITIONS IN ALL DESIGNATED VOLUME PAIR LISTS AS EXTRACTION TARGETS
312
TRANSFER EXTRACTED LIST OF DKC TO HOST COMPUTER CONNECTED TO ANY DKC AND REQUEST EXECUTION OF PROCESSING
313
RECEIVE DKC HAVING PATH FROM HOST COMPUTER
314
REGISTER, TO HOST PATH LIST, IDENTIFIER OF HOST AND IDENTIFIER OF DKC HAVING SUCCESSFUL COMMAND
315
END

FIG. 18

150b ROUTE LIST

```
<RouteList>
<ID>3DC</ID>
<route host=HA priority=1>
  <DKC hop=1, seq#=DA>
  <DKC hop=2, seq#=DB>
  <DKC hop=3, seq#=DC>
</route>
<route host=HC priority=1>
  <DKC hop=1, seq#=DC>
  <DKC hop=2, seq#=DB>
  <DKC hop=3, seq#=DA>
</route>
<route host=HA priority=2>
  <DKC hop=1, seq#=DA>
  <DKC hop=2, seq#=DC>
  <DKC hop=3, seq#=DB>
</route>
<route host=HC priority=2>
  <DKC hop=1, seq#=DC>
  <DKC hop=2, seq#=DA>
  <DKC hop=3, seq#=DB>
</route>
</RouteList>
```

FIG. 19

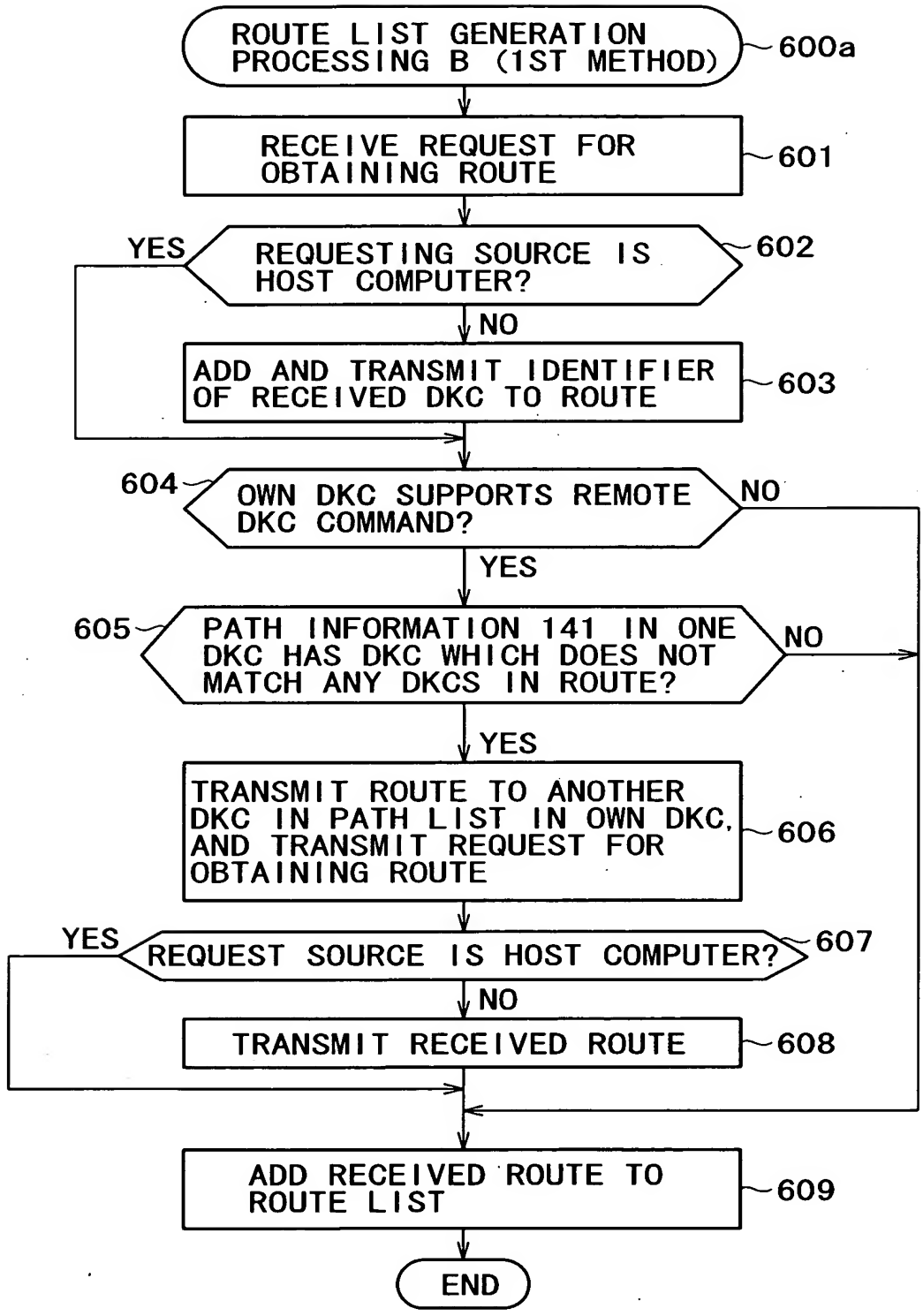

ROUTE LIST GENERATION PROCESSING B (1ST METHOD)
600a
RECEIVE REQUEST FOR OBTAINING ROUTE
601
YES
REQUESTING SOURCE IS HOST COMPUTER?
602
NO
ADD AND TRANSMIT IDENTIFIER OF RECEIVED DKC TO ROUTE
603
604
OWN DKC SUPPORTS REMOTE DKC COMMAND?
NO
YES
605
PATH INFORMATION 141 IN ONE DKC HAS DKC WHICH DOES NOT MATCH ANY DKCS IN ROUTE?
NO
YES
TRANSMIT ROUTE TO ANOTHER DKC IN PATH LIST IN OWN DKC, AND TRANSMIT REQUEST FOR OBTAINING ROUTE
606
YES
REQUEST SOURCE IS HOST COMPUTER?
607
NO
TRANSMIT RECEIVED ROUTE
608
ADD RECEIVED ROUTE TO ROUTE LIST
609
END

FIG. 20A

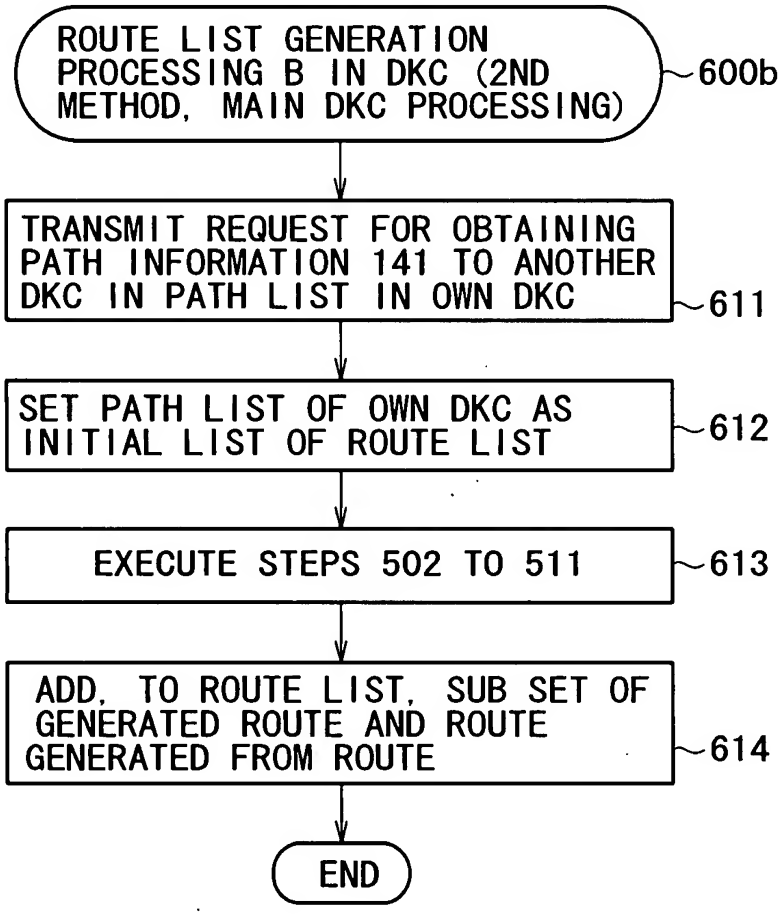


FIG. 20B

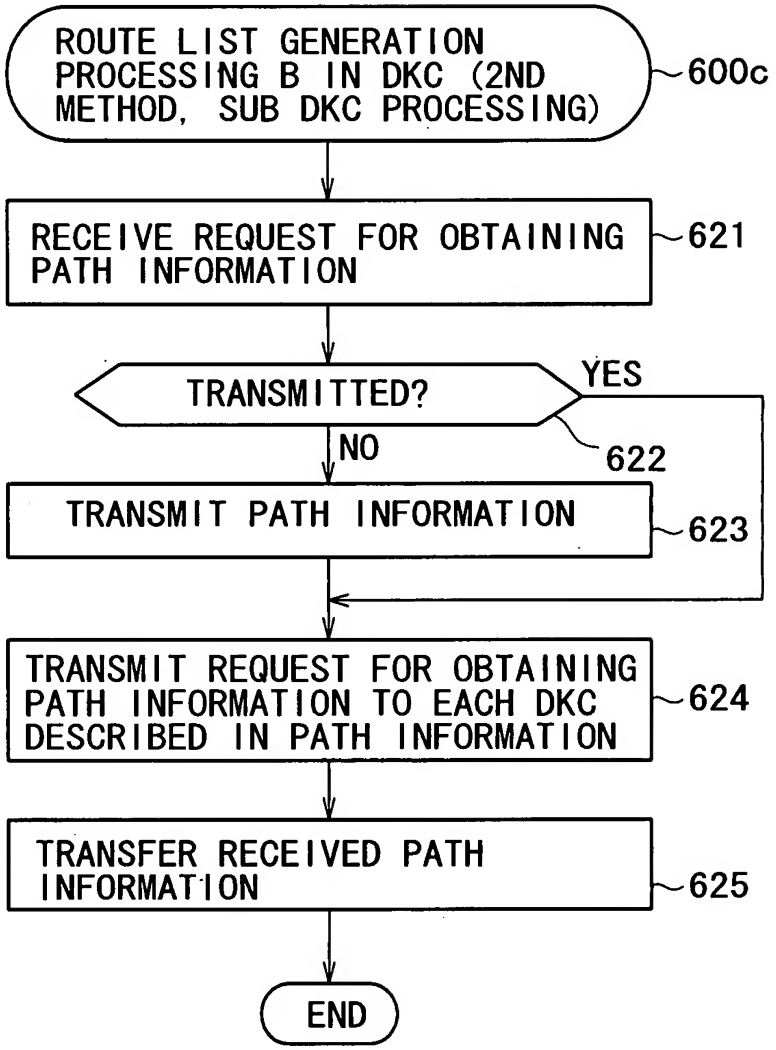


FIG. 21

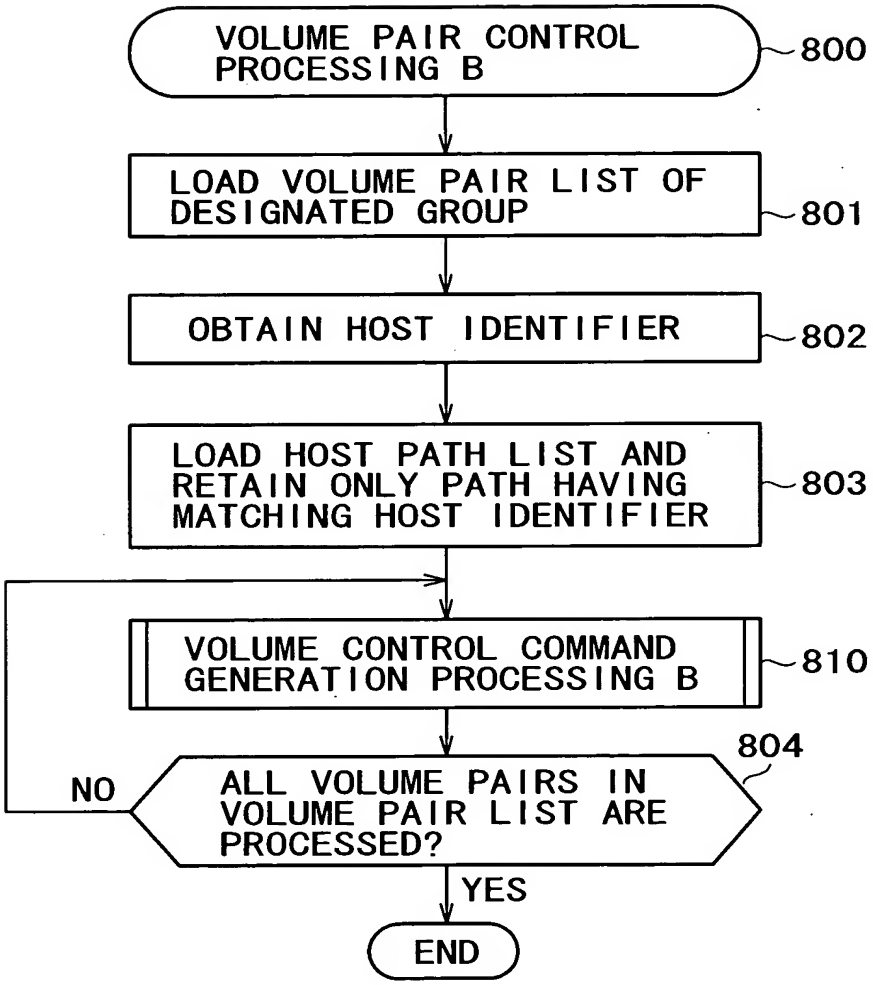

VOLUME PAIR CONTROL PROCESSING B
800
LOAD VOLUME PAIR LIST OF DESIGNATED GROUP
801
OBTAIN HOST IDENTIFIER
802
LOAD HOST PATH LIST AND RETAIN ONLY PATH HAVING MATCHING HOST IDENTIFIER
803
VOLUME CONTROL COMMAND GENERATION PROCESSING B
810
804
NO
ALL VOLUME PAIRS IN VOLUME PAIR LIST ARE PROCESSED?
YES
END

FIG. 22

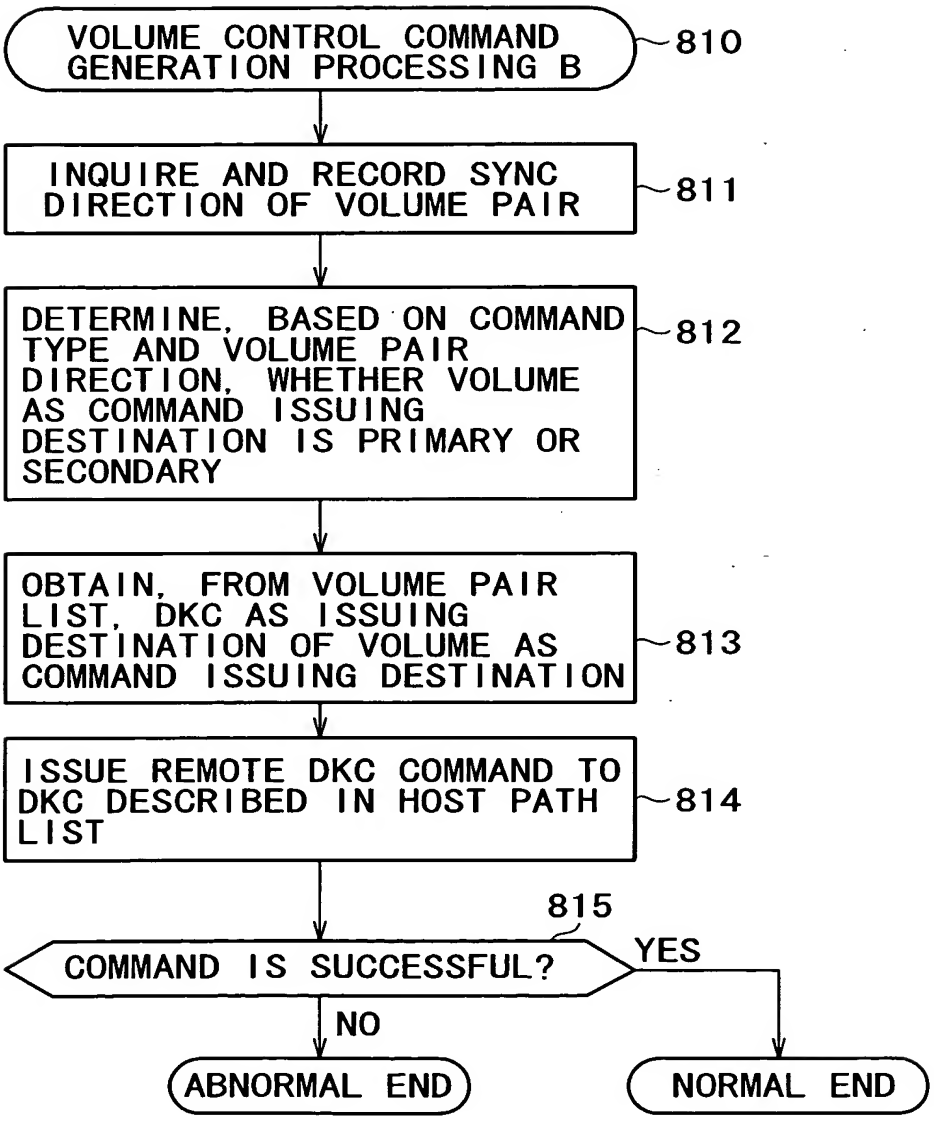
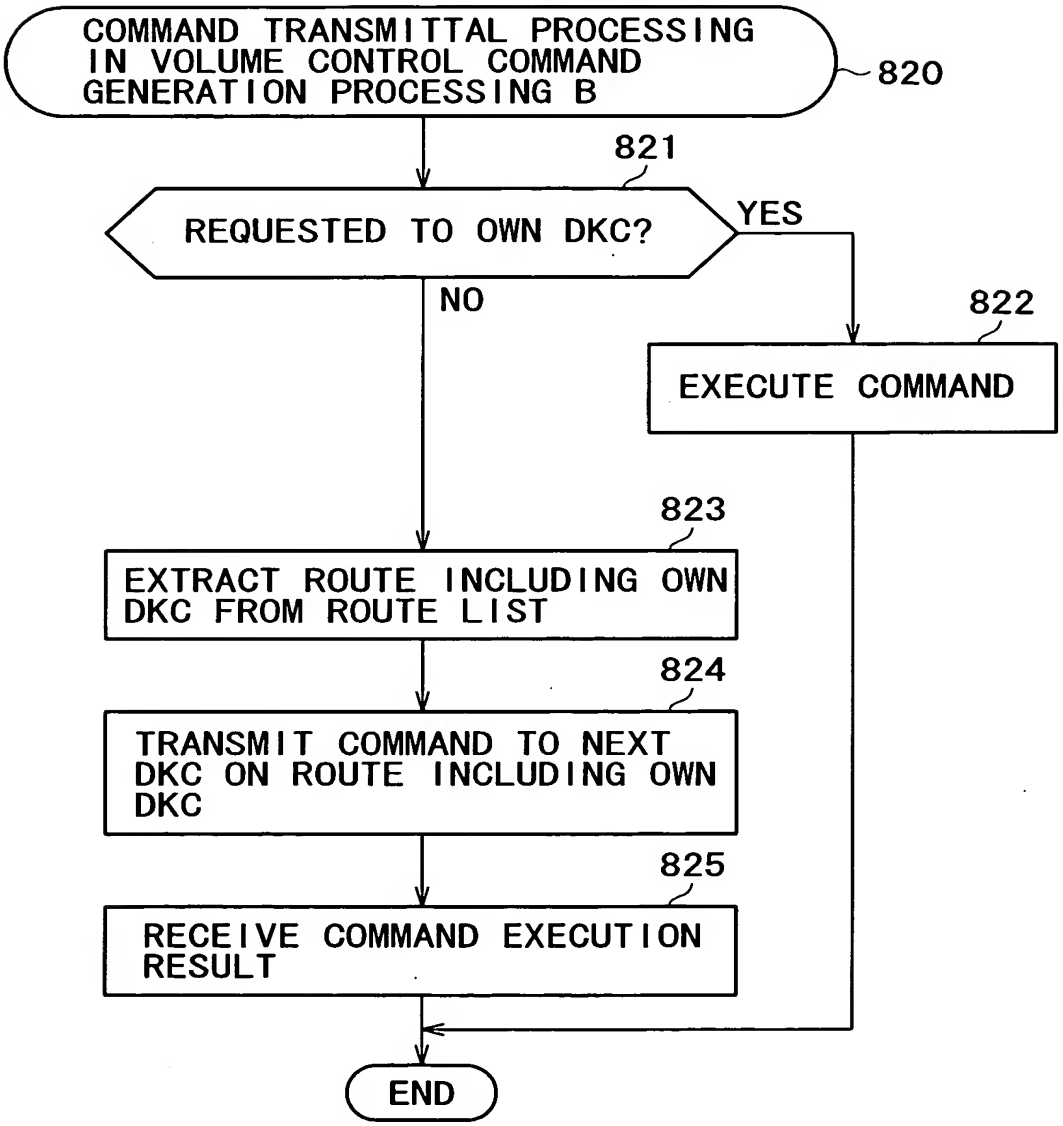

VOLUME CONTROL COMMAND GENERATION PROCESSING B
810
INQUIRE AND RECORD SYNC DIRECTION OF VOLUME PAIR
811
DETERMINE, BASED ON COMMAND TYPE AND VOLUME PAIR DIRECTION, WHETHER VOLUME AS COMMAND ISSUING DESTINATION IS PRIMARY OR SECONDARY
812
OBTAIN, FROM VOLUME PAIR LIST, DKC AS ISSUING DESTINATION OF VOLUME AS COMMAND ISSUING DESTINATION
813
ISSUE REMOTE DKC COMMAND TO DKC DESCRIBED IN HOST PATH LIST
814
815
COMMAND IS SUCCESSFUL?
YES
NO
ABNORMAL END
NORMAL END

FIG. 23


COMMAND TRANSMITTAL PROCESSING IN VOLUME CONTROL COMMAND GENERATION PROCESSING B
820
821
REQUESTED TO OWN DKC?
YES
NO
822
EXECUTE COMMAND
823
EXTRACT ROUTE INCLUDING OWN DKC FROM ROUTE LIST
824
TRANSMIT COMMAND TO NEXT DKC ON ROUTE INCLUDING OWN DKC
825
RECEIVE COMMAND EXECUTION RESULT
END